# "ROLE OF VISCOCANALOSTOMY AND SUB SCLERAL LAKE TRABECULECTOMY IN OPEN ANGLE GLAUCOMA"

## THESIS

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ANANT VIR JAIN

DEDICATED TO
MY TEACHERS
PAST, PRESENT
& FUTURE

# CERTIFICATE

Certified that the research work entitled "**Role of viscocanalostomy and sub scleral lake trabeculectomy in open angle glaucoma**" which is being submitted as thesis for M.S. (Ophthalmology) examination of Bundelkhand University, 2003 by Dr. Anant Vir Jain has been carried out in the Department of Ophthalmology, Maharani Laxmi Bai, Medical College, Jhansi.

He has also completed conditions of residency in the department as per university regulations.

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# CERTIFICATE

Certified that the research work entitled "**Role of viscocanalostomy and sub scleral lake trabeculectomy in open angle glaucoma**" was conducted by Dr. Anant Vir Jain under my guidance and supervision. The investigations, techniques and statistic mentioned in the thesis were carried out by the candidate himself and observations have been checked by me regularly.

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Guide

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Co-guide

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When it comes to express the heart-felt gratitude towards, those who were life and soul to this work, my situation is empty summed up by the lines "when the heart is full, the tongue is silent". Words if they could be adequately used would perhaps still not suffice in bringing forth the totality of my gratefulness for those concerned. Nevertheless, I will certainly not spare this fortunate opportunity of conveying my feelings in all their humbleness.

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At this moment of glory and award I humbly accept that all credit actually goes to my parents and wife Charu. Their affection, sacrifices and patience have made all this worthwhile.

My heartfelt gratitude and thankfulness is for the patients who were the base of this project to all of them I have to say "Without you this could not have been possible".

Anant Vir Jain

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# INTRODUCTION

# INTRODUCTION

Since ages people are trying to find a definitive treatment for glaucoma but the search is still on to find ways to prevent visual field losses in glaucoma.

In spite of more than 200 years of treatment by pressure lowering medication in glaucoma, it is still not brought to evidence that decreasing the intraocular pressure is our ultimate goal.

Glaucoma is now considered an optic neuropathy, not a disease of anterior chamber angle.

Many different drugs have been developed to lower the intraocular pressure: Pilocarpine, beta-blockers, adrenaline drugs and recently the prostaglandin analogs & prostamides. The older drugs facilitate the escape of aqueous humor through the trabecular meshwork. During the last 20 years drugs that diminish the aqueous production have been introduced and now recently drugs that facilitate the uveoscleral outflow have been put as a weapon to fight high intraocular pressure in Glaucoma.

The quests for the surgical management of glaucoma begin in the 18th century when William Mackenzie in 1830 suggested sclerotomy and Paracentesis as surgical treatment for chronic stage of glaucoma. Albert Von Graefe (1857) introduced iridectomy for treatment of glaucoma. Later many different operations were tried. Lately trabeculectomy, a guarded filtering procedure has been seen as the gold standard. Trabeculectomy is a well

tested operation to lower the intraocular pressure, but has quite a few complications as hyphema, shallow or flat anterior chamber, hypotony, choroidal detachment, and hypotony maculopathy all due to excessive filtration, blebitis and later cataract in 50% of the operated eyes.

A new approach to glaucoma surgery has evolved to minimize the complications just mentioned. Robert Stegmann of South Africa in 1996-1999 introduced a Non Penetrating Filtering operation known as VISCOCANALOSTOMY as a substitute for medical therapy for control of intraocular pressure as primary surgical procedure or in patients of primary open angle glaucoma who are on anti-glaucoma medication with uncontrolled intraocular pressure. Here the surgical complications due to conjunctival blebs and anterior chamber entry are almost eliminated.

The overall results of viscocanalostomy, a non penetrating filtering operation were encouraging, so viscocanalostomy was performed on patients of primary open angle glaucoma in the present study for further evaluation.

Also we at the Department of Ophthalmology, Maharani Laxmi Bai Medical College, Jhansi, modified viscocanalostomy by combining it with trabeculectomy in which sub scleral lake was made, without the formation of the conjunctival filtering bleb as a treatment for patients of primary open angle glaucoma and termed it SUB SCLERAL LAKE TRABECULECTOMY. The results of sub scleral lake trabeculectomy are also evaluated in this study.

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# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

Glaucoma has affected the mankind ever since the emergence of mankind on the earth. But it was not recognised by the Classical and the Alexandrian Greeks as a specific disease and was considered as a part of cataract. The term GLAUCOMA (γλαυχομα) was first used by Hippocrates in 420 B.C. to describe blindness coming on in advancing years associated with the glazed appearance of the pupil – "If the pupil becomes sea coloured the sight is destroyed and blindness of other eye often follows."

The word glaucoma has usually been interpreted as implying a greenish or bluish hue, but it is more probable that to the Greeks it indicated no specific colour but the dull sheen or "glaze" of blindness. The term was used without any specific pathological connotations and represented no morbid entity, but probably included absolute glaucoma among other conditions. Glaucoma as we know today was vaguely classified as amblyopia, amaurosis, or gutta serena. Originally it was undifferentiated from cataract; both diseases were located in the lens, then considered the essential organ of vision, and both depended on a disturbance of visual sprits. Only at later date it was recognised by Celsus (25 B.C.- A.D. 50) and Rufos of Ephesus (95-117) and later by Glen (131-210) and other writers of early centuries that the morbid condition situated behind the pupil which gave rise to blindness could be differentiated in to two groups, "suffusions" or cataracts which were amenable to cataract treatment, and the glaucoma which were not. Michael

Brisseau (1709) of Paris for the first time showed that cataract was an opacification of the lens and disproving any lenticular abnormality in glaucoma by anatomical examination of the eyes of Bourdelot, the blind physician of Louis XIV.

The first suggestion of a disease associated with a rise in intraocular pressure and thus corresponding to what is known as glaucoma seems to occur in Arabian writings of At-Tabari ($10^{th}$ century) who wrote in the "Book of Hippocratic treatment" of chronic inflammatory conditions of eye with raised tension. The first original and clear recognition of such a condition in European writing is by Richards Bainster (1622), who in his book on Ophthalmology clearly differentiated between a curable cataract (gutta obscura) and glaucoma (gutta serena) wherein "the humour settled in the hollow nerves, be grown to any solid or hard substance, it is not possible to be cured", and gave a tetrad of features: tension with long duration of disease, the absence of perception of light and the presence of fixed pupil. Antoine-Pierre Demours (1818) gave the first excellent description of Glaucoma with raised ocular tension; he noted and described for the first time the appearance of colours of rainbow around lights.

In Germany Karl Heinrich Weller (1826) wrote of the hardness of eye not only in established but also in the developing condition, and described two entities Arthritic ophthalmia without a greenish pupil and glaucoma wherein this was present. In London, G.J. Guthrie (1823) recognised hardness of the eye as characteristic of a disease which he called glaucoma.

With the introduction of the Ophthalmoscope, clinical observations on the glaucomatous cup begin to accumulate (Jacobson, 1853; Von Graefe, 1854-57; Weber, 1855; and others). These observations about cupping of optic disc were confirmed by the pathological researches of Heinrich Muller (1856). Von Graefe (1857) divided glaucoma on the basis of clinical picture in to three categories- acute, chronic and secondary, and the anomaly that Ophthalmoscope had lately revealed in the eyes with on signs of congestion as "amaurosis with excavation of the optic nerve". The final important clinical observation was the unifying concept of Donders (1862), who recognised the last condition wherein an incapacitating increased tension occurred without any inflammatory symptoms as simple glaucoma.

Max Knies (1876) and Adolf Weber (1877) discovered that there is increase in frequency of obstruction of the angle of anterior chamber in glaucoma. Priestley Smith (1879-91) stressed faulty drainage rather than the theory of overproduction of fluid as the cause of glaucoma.

With the aid of early types of Gonioscope, Salzmann (1914-15), Troncoso (1925-35), Thorburn (1927) and Sigurd Werner (1932) pointed out that in some glaucomatous eyes the angle of anterior chamber was closed while in others it was open. Otto Barkan (1938) with an improved type of Gonioscope used with a contact lens divided glaucoma on one hand, with deep anterior chamber and an open angle, on the other hand, with a shallow

anterior chamber the drainage angle of which closed to produce a rise in tension.

The glaucoma is classically defined as a symptom complex in which the intraocular pressure of the eye is not compatible with the normal physiological functioning of the eye, with diurnal variation of more than 5mm Hg of intra ocular pressure and is associated with visual field changes.

Von Graefe (1857) was first divided glaucoma on the basis of clinical picture in to three categories- acute, chronic and secondary, and the anomaly that Ophthalmoscope had lately revealed in the eyes with on signs of congestion as "amaurosis with excavation of the optic nerve". Donders (1862) recognised the last condition wherein an incapacitating increased tension occurred without any inflammatory symptoms as simple glaucoma. Thereafter it became generally accepted that two main types of disease existed, primary glaucoma occurring without other obvious diseases of eye, secondary glaucoma occurring as a result of other ocular diseases, as well as congenital glaucoma. For many years the standard classification of primary glaucoma embraced two categories: chronic simple and congestive; the later being divided in to two phases, acute and chronic. The ultimate stage of both is known as absolute glaucoma. Barkan (1938) established the concept of acute glaucoma as being anatomically determined by pupillary blockage and closure of drainage angle and suggested the terms wide-angle and narrow-angle, or subsequently, open-angle and close-angle glaucoma. Gradle (1924-46) divided closed angle type into four stages:

1. Pre- glaucoma: Here the angle is narrow, although allowing adequate drainage, potentially leads to attacks of raised tension or intermittent attacks.
2. Intermittent: Periodic transient attacks of raised tension which causes no organic or functional damage
3. Acute: Acute phase of raised tension
4. Chronic: Closed angle glaucoma wherein the drainage is permanently blocked by peripheral anterior synechiae.

Glaucoma was classified by in the International Symposium on Glaucoma in 1954 (Duke-Elder, 1955) into three types:

A) Primary Glaucoma – not due to obvious disease in the eye.

1. Simple Glaucoma
2. Closed Angle Glaucoma, which has four phases:
    - Pre- Glaucoma
    - Intermittent
    - Acute
    - Chronic

B) Secondary Glaucoma – due to pre-existing ocular disease; it may be either of open or closed angle type.

C) Congenital Glaucoma (Buphthalmos) due to obstruction of drainage by congenital anomalies.

The primary and secondary glaucoma are differentiated on the basis of presence or absence of the associated factors contributing to the pressure

rise. These primary and secondary glaucoma are further sub classified as open angle and angle closure type depending upon the status of the anterior chamber angle.

Cases exist wherein the typical changes at optic disc and defects in visual field occur, while there is no rise in intra ocular pressure and no diurnal variation of intra ocular pressure nor can be raised by provocative tests when account is taken of ocular rigidity. These cases have been termed low-tension glaucoma or pseudo-glaucoma by de Wecker (1896). These changes are usually due to ischemia of optic nerve caused by vascular insufficiency. By the middle of 20$^{th}$ century, the existence of low tension Glaucoma was firmly established and is now widely known as Normal Tension Glaucoma.

With emergence of normal tension glaucoma, the term glaucoma is now defined as a progressive Optic neuropathy which results from specific pathophysiological changes in the Retinal ganglion cell axons or Optic nerve fibres causing a characteristic structural changes in the Optic nerve head and the functional changes in the visual field which may or may not be associated with the rise in the intra ocular pressure.

Glaucoma accounts for 2% of blindness in India, out of which half are of open angle type. The elevation of the intra ocular pressure in open angle glaucoma is due to the obstruction of aqueous outflow caused mainly by the alteration in the trabecular meshwork. Other mechanism include collapse of Schlemm`s canal, alteration in the intrascleral channels or influence of aqueous humour. This rise in the intra ocular pressure causes damage to the

Retinal ganglion cell axons or Optic nerve fibres and subsequently blindness.

Elevated intraocular pressure is the most treatable risk factor for glaucoma. The finding that the relative low intraocular pressure targets can slow or halt the progression of glaucoma is significant because the ultimate goal of glaucoma therapy is to minimize the visual loss it inflicts. Accordingly, the principal goal of glaucoma management is to reduce intraocular. Increasingly, this knowledge is leading to the setting of target pressure that is individualised to each patient as progression in glaucoma, often occurs at what are sought to be physiological pressures. The target pressure is determined by initial intraocular pressure level when the diagnosis was made, the degree of optic nerve damage, and the general health of the patient. The lower the initial intraocular pressure, the older the patient, the more advance the optic nerve damage, and the presence of cardiovascular disease or diabetes, the lower the target pressure must be set. This is most often achieved pharmacologically by decreasing the aqueous humor production and /or by increasing aqueous outflow; and can also be attained by various surgeries.

In olden days the medical treatment of simple glaucoma was confined to the chronic and absolute phase of the disease when the therapies consisted of bathing the eyes with vegetable derivatives. In second half of the 19$^{th}$ century almost simultaneously Adolf Weber (1876) advocated the use of the extract of Jaborandi (Pilocarpine) and Ludwig Lacquer (1876-77) of Calabar bean (Physostigmine, Esrine). By the middle of the 20$^{th}$ century, many

cholinergic drugs and cholinesterase inhibitors have been synthesized so that today the wide range of miotics have been introduced in to the pharmacological armamentarium.

Darier (1900) started the use of sympathomimetic drugs as an ocular hypertensive agent by treating the glaucoma patients with subconjunctival injections of epinephrine. Hamburger (1923-24) used epinephrine topically to reduce intraocular pressure. Sympatholytic drugs were introduced with the compound of Ergot by Thiel in 1924.

Cantonnet (1904) started osmotic therapy by administrating sodium chloride by mouth, later by Hertel (1913-15) who gave intravenous injection of saline. This technique was followed by the use of more effective substances such as Sorbitol or Urea intravenously or glycerol by mouth. Becker (1945) used carbonic anhydrase inhibitors initially acetazolamide.

Phillips and co-workers (1976) reported that an intravenous injection of Propranolol, a β-adrenergic antagonist lowered intra ocular pressure in humans. With in a short time Cote g. Drance SM (1968) & Ohrstrom A (1973) found that oral, and Bucci MG (1968) & Weinstein P found that topical Propranolol also reduced intraocular pressure. Later on Katz (1976), Vareilles (1977), Zimmerman and Kaufman (1977) established Timolol Maleate a β-adrenergic antagonist as an effective therapy for glaucoma. Additional topical β-adrenergic antagonist agents as Betaxolol, Levobunolol,

Metipranolol, Carteolol, and Timolol hemihydrate have been subsequently added to the armamentarium.

The experimental observations showed that topical prostaglandins produced first an increase, and later a profound decrease in intraocular pressure, and because of clinical observation that the intraocular inflammation was accompanied by low intraocular pressure (Starr MS, 1971), work begin to determine if one or more of the prostaglandins might be of value in glaucoma. Camras and Bito (1981) produced a reduction in intra ocular pressure in monkey eyes lasting up to three days with use of relatively high topical dose of prostaglandin F2 ($PGF_2$). The first usable prostaglandin was developed in Japan. Isopropyl Unoprostone (Rescula) is a prodrug that is derived from a pulmonary metabolite of $PGF_2$ lowers intraocular pressure in dose dependent fashion with twice daily dosing, and is well tolerated (Takase M, 1992). Later on A. Alm (1993), Y. Hotehana (1993), S. Nagasubramanian (1993) established Latanoprost (PHXA41) a PGF2 agonist as one of the most potent intra ocular pressure lowering agent available today.

Very recently a new molecule known as Prostamide was discovered, which is derived from anandamide – a naturally occurring cell membrane lipid. In 1999 it was found to be potent and highly efficacious ocular hypotensive agent (Woodward DF, Krauss AH-P, Chen J – 2001; Brubaker RF, Schoeff EO, Nau CB – 2001). The intraocular lowering effect exerted by Prostamide is achieved by enhancement of aqueous humor outflow through both the

trabecular meshwork and uveoscleral routes. A synthetic Prostamide analog, Bimatoprost was synthesised that selectively mimics its ocular hypotensive effects and is used as a 0.03% ophthalmic solution to reduce intraocular pressure in patients with glaucoma or ocular hypertension.

Surgical procedures devised for the relief of glaucoma should ideally be such as to preserve the visual functions of the eye, maintain its tension within normal limits, and retain the integrity of the globe. The number of operations advocated from time to time is evidence that this ideal has not been attained till date.

First surgical procedure for glaucoma was suggested by William Mackenzie in 1830. He suggested Sclerotomy and Paracentesis as surgical treatment for chronic stage of glaucoma. A Paracentesis was a temporary expedient; the first to attempt to make it permanent was Gorge Critchett (1857), who in his operation of iridodesis, drew a piece of iris with a blunt hook into the wound made at the limbus for a Paracentesis , thus introducing the idea of drainage by an iris inclusion.

Albert Von Graefe (1857), observing the recession of staphyloma after an Iridectomy presumably owing to the relief of raised tension, announced the effect of a basal iridectomy in the treatment of acute glaucoma but, while the effect in this type of disease was acclaimed to be revolutionary and dramatic, equally good results were found to be absent in the more chronic forms

unless, the iris was incarcerated in the scar (Coccius, 1859-63; Baber, 1881; Parinaud, 1901).

Louis De Wecker (1868-71) devised anterior sclerotomy with a view to increase the drainage of aqueous by formation of a filtering cicatrices. In this procedure, after a puncture and counter puncture had been made just behind the limbus, the knife cuts in a short distance as in making an incision for cataract and then was slowly withdrawn leaving the upper pole of the limbus uncut. The operation was practised by Stellwag Von Carion (1870) and Quaglino (1871) and at a later date was improved by de Wecker (1894) himself by making a dialysis in addition and subsequently combining it with iridectomy (1901); but the results remained unsatisfactory for the wound tend to close even although the operation was followed by a prolonged massage (Dianoux, 1905).

Major H. Herbert of Bombay in 1903 devised Small Flat Sclerotomy. In which a small incision was made into the anterior chamber through the sclera behind and parallel to the limbus and at the either end two cuts were made perpendicular to the corneal margin thus leaving a rectangular trap-door of sclera with its base attached to the cornea. In the operation he deliberately induced a prolapse of iris protracted by a flap of conjunctiva in the scar. In a later suggestion, the wedge resection of Herbert (1913), he isolated a wedge of sclera at the limbus attached to conjunctiva only so that it shrivelled, a technique further amplified by Cruise (1921-47).

Soren Holth (1907) popularised the iris inclusion in his technique known as iridencleisis. In this operation, under a conjunctival flap reflected to the limbus, anterior chamber is opened by a keratome which enters the sclera 2 mm behind the limbus and is directed towards the filtering angle. The scleral lip of the section is depressed so that the iris prolapses in the wound; this tissue is then cut in the 12 o' clock meridian from the margin of pupil to its root; the nasal pillar is drawn outwards over the sclera; the temporal pillar is reposed; and the conjunctival flap sutured. Subsequent massage of the eye is usually considered necessary to ensure a continuous drainage because of the tendency to cicatrisation. L. and R. Weekers (1948) modified it by prolapsing the iris and then tearing it with iris forceps. Troutman (1954) demonstrated that the inclusion of two pillars of iris in the scleral wound was more effective than the one pillar, the former procedure being successful in 90% and later in 69% of cases. The main complications of this procedure were sympathetic ophthalmitis and late infections.

The production of a filtering scar by sclerectomy was another expedient adopted to secure drainage. This idea was first introduced by Douglas Argyll Robertson (1876) of Edinburgh in his technique of posterior trephining. He trephined at the junction of pars plana and ciliary body, reported 4 cases with reasonably satisfactory results. This idea of draining the suprachoroidal space was pursed by Freeland Fregus (1909-15), who improved upon it by introducing a spatula through the opening into the anterior chamber thus combining trephining with Cyclodialysis. Colonel Robert Henry Eliot (1902-32) of Madras revolutionised this idea by introducing corneo scleral

trephining at the limbus. Sclerostomy was further pursued by French surgeon, Felix Lagrange (1906-7), who finally achieved de Wrecker's inspiration of establishing a filtering scar of permanent nature. Later the fashioning of similar type of drainage scar by cauterizing the sclera was sought by Count Luigi Preziosi (1924) and was further elaborated by Harold Scheie in 1958 who introduced cauterization of Sclera with peripheral iridotomy, known as thermal sclerostomy or Scheie Procedure.

Another type of operation depends on the establishment of drainage channels with in the eye. Such a procedure is done incidentally in other techniques and was first conceived by Leopold Heine (1905) as a primary operation in his technique of cyclodialysis. As with other filtering operations, attempts have been made to maintain the patency of cyclodialysis cleft by the introduction of foreign materials, initially by Row (1934).

With reasoning that Glaucoma was caused by a failure of the aqueous to reach Schlemm's canal, Italian surgeon de Vincentiis (1893) conceived the idea of opening the canal by a knife introduced in to the anterior chamber known as trabeculotomy. His attempt was unsuccessful because he could not see where he was going. This feat was achieved by Otto Barkan (1936-38); he with an aid of contact glass and intense transilluminator devised a technique by which the canal can be cut open from within.

Synthetic devices or Setons are used in Glaucoma Surgery to maintain patent drainage fistula. Rollet (1907) used Horse hair, Bock (1950) used Glass tube, Qadeer (1954) used Acrylic Plates, Epstein (1959) and others used Polythene tubes and Ellis (1960) used silicone tubes. In 1969 Molteno established the idea of connecting a tube from anterior chamber to a drainage field provided by an acrylic plate (Molteno, 1969-68). Later it was modified by Schocket and Co-workers by shunting the aqueous via tube to encircling band (1982-86). Then came the Ahmed valve which has a valve feature that restricts flow of aqueous below 7mm of Hg, helping to minimize postoperative hypotony. It is a single plate design that avoids multiquardant surgery and involvement of extraocular muscles (Prata JA Jr and others, 1995). Clinical experience with Ahmed valve has produced pressure lowering results that are similar to other implantation devices; postoperative complications associated with over filtration appear to occur less frequently with Ahmed valve implants than with most alternatives (Coleman AL and others, 1995). Complications of drainage implants includes erosion of the tube and plates, cataract formation, corneal decompensation caused by endothelium-tube contact, hypotony with all its accompanying problem (including suprachoroidal haemorrhage), and blockage of either end of the tube by ocular contents in the anterior chamber or fibrosis at the bleb end. Endophthalmitis and phthisis bulbi though rare, can be seen. So these devices are not appropriate for initial surgery in uncomplicated primary open angle glaucoma, but their risk is reasonable in more severe cases as neovascular glaucoma, aphakic glaucoma, and advanced developmental glaucoma (Ancker E, Molteno AC – 1980; Brown RD, Cairns JE – 1983).

Various destructive procedures are also done on the ciliary body. Following the observation of Weve (1932) that extensive surface diathermy on ciliary body frequently resulted in ocular hypotension, Vogt (1936) proposed the operation of penetrating cyclodiathermy for various forms of glaucoma. Because of frequent postoperative complications, he modified his technique to partial penetrating cyclodiathermy (Vogt, 1937-39), while others have suggested that nonpenetrating is just as effective with fewer complications. Cyclodiathermy acts by reducing the formation of aqueous (R. Weekers and Prijot, 1952; Scheie et al., 1955) and on histological examination partial atrophy of ciliary body has been shown to occur in some cases (Scheie et al., 1955). Next came the cyclocryosurgery, in which the application of low temperature to the region of ciliary body also results in a reduction of ocular tension, and this form of cryosurgery is remarkably free from complications (Bietti, 1947-50; Krwawicz and Szware, 1965; de Roetth, 1966; Haye et al., 1967). With the advent of laser cyclophotocoagulation procedures came in to being, to destroy elements of the ciliary body. Cyclophotocoagulation tends to have fewer complications than dose cyclocryodestruction (Suzuki Y and others, 1991), but most glaucoma specialists do not attempt cyclophotocoagulation until other attempts at intraocular pressure reduction have failed.

Cairns in 1968 introduced modern day trabeculectomy. It was initially believed that the aqueous escapes through the cut ends of Schlemm's canal but it subsequently became obvious that the major effect of the surgery

occurred through via filtration of aqueous through the subconjunctival space (Spencer 1972). This operation possibly avoided shallow or flat anterior chamber post operatively which was a major problem with unguarded filtering surgeries. Trabeculectomy has now become the standard glaucoma procedure, with excellent results for most forms of open angle and chronic angle closure glaucoma. Aphakic, inflammatory, traumatic, and other secondary forms of uncontrolled glaucoma also are treated with trabeculectomy; success rates are good when wound healing retardants or wound modulators as 5 Fluorouracil and Mitomycin-C were used in Trabeculectomy (Chen CW and others, 1990; Lamping KA, Belkin JK – 1995; Prata JA Jr. and others, 1995).

When the filtering Sclerostomy is protected from excessive flow either by partially closing it with scleral flap or by suturing techniques, it is described in terms such as guarded, protected sub-scleral, or partial thickness filtering surgery. The advantage of such techniques is that the initial egress of aqueous from the anterior chamber is retarded, which reduces the incidence of postoperative flat chambers (Wilson MR, 1989). This decrease in incidence of postoperative hypotony and flat chamber appears to reduce inflammation, peripheral anterior synechiae, and cataract formation as well. Guarded filtration procedures may also reduce the long term success rate of surgery and prevent attainment of the very low pressure that seems desirable in advanced glaucoma or normal tension glaucoma (Lamping KA and others, 1986).

Procedures such as thermal sclerostomy, posterior or anterior lip sclerectomy, or Elliott's trephination has no guard over the external surface of sclerostomy other than conjunctiva and tenon's capsule. These procedures are labelled as full thickness filtration surgery. Such procedures may be preferable if very low pressures are desirable as in normal tension glaucoma or if guarded filtering surgery has failed (Papst w. Brunke R, 1980).

External filtration surgery achieves reasonable intraocular pressure lowering in 65% to 85% of adults, depending upon the condition of the eye, the use of antimetabolites, the healing tendencies of the eye, and the skill with which the surgery is performed. This success rate may be increased to over 90% if eyes in which antiglaucoma medication use was resumed was included.

It is difficult to compare surgical results because of variation of techniques and definitions of success. In a prospective, randomised study of the difference between thermal sclerostomy and trabeculectomy, Blondeau and Phelps (1981) reported intraocular pressures less than 22 mm of Hg in 65% of thermal sclerostomies and 76% of trabeculectomies followed up for 5 years. When medications were added, the success rate rose to 91% of the eyes treated with thermal sclerostomy and 94% of those treated with trabeculectomy. Pressure tends to be somewhat lower in eyes undergoing thermal sclerostomy, but visually significant cataracts occurred three times more often and hypotony twice as often with thermal sclerostomy (Blondeau and Phelps, 1981). Thinner blebs were more frequent with thermal

sclerostomy. Even eyes with no detectable bleb at 5 years (approximately 1/3 of the total), however had intraocular pressures of 17 mm Hg.

In another retrospective study of comparison of full thickness filtration versus trabeculectomy, Lamping KA and others (1986) found that the former offered much better long term pressure control. They noted an equal frequency of problems with hypotony with guarded and full thickness procedures.

In various studies on eyes with open angle glaucoma, which were treated trabeculectomy, pressure level of 21 mm of Hg or lower with or without medication are achieved in 80% to 90% of eyes (Spaeth GL, 1980; Lewis RA, Phelps CD – 1984; Sharma SL, Singh T – 1981; Shields MB, 1980; Spaeth GL, Poryzees – 1981; Watkins PH Jr, Brubaker RF – 1978).

The experience with trabeculectomy with a scleral flap, with or without use of low concentration of antimetabolites and releasable sutures is quit good. But there are complications associated with it as:

1. Hypotony and flat anterior chamber (Spaeth GL – 1990; Migdal C, Hitchings R – 1988; Burney EN, Quigley HA, Robin AL – 1987)
2. Uveitis and Hyphema (Lundy DC – 1996; WuDunn D – 1997)
3. Hypotonus Maculopathy (Dellaport A – 1955; Gass J – 1972; Altan T – 1994)
4. Dellen (Mai G, Yang S – 1991)
5. Blebitis (Ciulla TA – 1997; Chen PP – 1997; Brown RH – 1994)

6. Endophthalmitis (Kangas TA – 1997; Dhaliwal R, Meredith T – 1995)
7. Cataract (Blondeau and Phelps, 1981)
8. Late complications such as failure of filtration, conjunctival scaring, over drainage of Filtering Bleb, spontaneous Hyphema, Ciliochoroidal detachment (Stamper RL, Liberman MF, Drakes MV – 1999).

Most of these complications occur due to conjunctival blebs and anterior chamber entry.

In last decade of 20$^{th}$ century a new approach to glaucoma surgery has evolved to minimize the complications just mentioned. Robert Stegmann of South Africa in 1996-1999 introduced a Non Penetrating Filtering operation known as VISCOCANALOSTOMY as a substitute for medical therapy for control of intraocular pressure as primary surgical procedure or in patients of primary open angle glaucoma who are on anti-glaucoma medication with uncontrolled intraocular pressure. Here the surgical complications due to conjunctival blebs and anterior chamber entry are almost eliminated.

Stegmann R, Pienaar A, Miller D (1999) performed viscocanalostomy in 214 eyes of black African patients with open angle glaucoma that was poorly controlled by medical therapy. They achieved postoperative intraocular pressure of 22 mm of Hg or less without any medical therapy in 82.7% of eyes. If beta blocker was added to the cases not achieving intraocular pressure of 22 mm of Hg or less postoperatively, the success rate increased to 89%. The average follow up was 35 months (range 6 to 64 months). They concluded that viscocanalostomy produced an encouraging

long term reduction in the intraocular pressure of black African patients with glaucoma who would otherwise have had a poor prognosis.

Dr G. Sunaric-Megevand reported an 86% success (20% with medications) for achieving pressures 20 mmHg in a mixed group of eyes undergoing viscocanalostomy.

C. Lüke, T. S. Dietlein, P. C. Jacobi, W. Konen and G. K. Krieglstein in their study to assess the efficacy and postoperative complications of viscocanalostomy versus trabeculectomy selected forty eyes of forty patients with medically uncontrolled open-angle glaucoma were randomized either to the viscocanalostomy or to the trabeculectomy group of the trial. The mean preoperative intraocular pressure (IOP) was 26.7 (SD 6.3) mmHg for all patients enrolled. The mean postoperative IOP was 10.5 (SD 6.60) for the trabeculectomy group and 17.1 (SD 7.0) for the viscocanalostomy group, respectively. The postoperative IOP-difference between the two groups was statistically significant ($p = 0.007$). The success rate, defined as an IOP lower than 21 mmHg without medication, was 60 % in the trabeculectomy group and 15 % in the viscocanalostomy group at 12 months postoperatively ($p = 0.004$). The number of postoperative complications was lower in the viscocanalostomy group. They concluded that in eyes with open angle glaucoma, viscocanalostomy is less effective in reducing postoperative IOP than the standard filtering procedure. However, the risk profile appears to be more favorable in the eyes treated with Viscocanalostomy.

D.P.S. OÌBrart, E .Rowlands, N. Islam at St. Thomasì Hospital, London compared trabeculectomy with viscocanalostomy for the control of intraocular pressure (IOP) in open angle glaucoma (OAG) uncontrolled by medical therapy. 48 patients (50 eyes) were randomised to trabeculectomy (25 eyes) or viscocanalostomy (25 eyes). Those undergoing trabeculectomy were given intraoperative antimetabolites (5-Fluoruracil 25mg/ml (5-FU), Mitomycin-C (MMC) 0.2gm/ml and 0.4mg/ml) according to a protocol. Antimetabolites were not used in eyes undergoing viscocanalostomy, but were randomised to the use of viscoelastic (Healonid GV) for intra-operative intracanalicular injection. There were no differences between the groups in age, sex, type of OAG, preoperative medications, risk factors for drainage failure and preoperative IOP. Mean follow up was 19 months (range 6-24 months). It was 12 months or longer in all eyes, except one. At 12 months, complete success (IOP >21mmHg without anti glaucoma medications) was seen in all eyes undergoing trabeculectomy (100%) but in only 64% of eyes undergoing viscocanalostomy ($p>0.001$). The mean IOP at 12 months was lower in eyes that had undergone viscocanalostomy using intra-operative intracanalicular Healonid GV injection compared to those where only balanced saline solution had been used ($p>0.01$). In terms of complete success there was no difference between the viscocanalostomy groups ($p>0.1$). With the exception of measurements at one week, visual recovery (log MAR acuity) was similar and laser flare and cell values showed little differences between the groups. Early bleb leaks and hyphema ($p>0.05$), as well as cataract formation were more common after trabeculectomy

(p>0.05). They concluded that IOP control is better with trabeculectomy. Viscocanalostomy is associated with fewer post-operative complications, although significant complications permanently impairing vision did not occur with either technique.

Carassa RG, Bettin P, Fiori M, Brancato R (1999) performed viscocanalostomy in 33 eyes of 33 patients of glaucoma, uncontrolled despite maximum medical therapy. In 4 eyes Schlemm's canal was either missed or not deroofed properly. After a mean follow up of 3.0 +/- 2.6 months (range 1 – 10 months), success defined as intraocular pressure >2 and <21 mm of Hg with no medication was obtained in 86.2% of cases (25/29). They concluded that Viscocanalostomy in short term study proved safe and effective in lowering intraocular pressure in glaucomatous eyes.

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# AIMS AND OBJECTIVES

# AIMS AND OBJECTIVES

To study the postoperative intraocular pressure of the patients of open angle glaucoma being treated with viscocanalostomy or sub scleral lake trabeculectomy.

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# MATERIALS AND METHODS

# MATERIALS AND METHODS

The present study was conducted at M.L.B. Medical College, Jhansi. It includes the patients of open angle glaucoma, who attended the O.P.D. of department of Ophthalmology and were free from systemic or other ocular disease.

The patients were of either sex. A total of 20 patients were studies for viscocanalostomy and 40 were studies for sub scleral lake trabeculectomy.

The following pattern was adopted for almost all the patients.

## *HISTORY OF PRESENT ILLNESS:*

History of diminution of vision, its rate of progression; any history of headache and eye pain, its severity, duration and association with vomiting, coloured halos, redness, discharge and watering of eyes was inquired and recorded. History of antiglaucoma therapy as well as any other ocular therapy was asked and recorded.

## *PAST HISTORY:*

Past history regarding previous ocular diseases and their treatment was asked and noted. History of ocular trauma or other visual disturbances was

taken. History of diabetes, hypertension and tuberculosis is also inquired and noted.

## *PERSONAL HISTORY:*

History of smoking, tobacco chewing, and addiction to alcohol or drug is taken. Inquiry is also made about cough, constipation and straining while micturation.

## *EXAMINATION:*

GENERAL EXAMINATION –

Recording of pulse, temperature, respiratory rate and blood pressure was done and noted.

SYSTEMIC –

Examination of Cardio vascular system, Central Nervous system, Respiratory system and G.I. tract was done.

LOCAL EXAMINATION (EYE EXAMINATION) –

The local examination was done under bright illumination to examine the conjunctiva, cornea, anterior chamber, iris, pupil and lens.

The slit lamp examination was done routinely particularly to examine the transparency of cornea, aqueous flare, keratic precipitates, extent of

lenticular opacities, pigment dispersion over the lens and to elicit pupillary reaction in doubtful cases.

## INVESTIGATIONS:

Routine investigations as random blood sugar, urine albumin & sugar, total leucocyte count, differential leucocyte count, haemoglobin % and erythrocyte sedimentation rate was done.

## SPECIAL EXAMINATION:

1) Visual Acuity –

Best corrected visual acuity was recorded preoperatively in terms of Snellen's test type, finger counting, hand movement, perception of light and projection of rays depending upon the individual's visual status. Post operatively it was recorded after 1 week, 2weeks, 6 week, 6 months, 1 year.

2) Pupillary Examination –

Pupils of both eyes were examined with the help of slit lamp for:

- Pupillary reaction
- Size of pupil
- Shape of pupil
- Presence of any synechiae

3) Examination of lens –

Lens was examined for cataractous changes by slit lamp and is graded into:

i. Cortical

- Lamellar separation
- Incipient cataract
- Intumescent cataract
- Mature cataract
- Hypermature cataract

ii. Nuclear sclerosis

Post operatively cataractous changes are noted after 6weeks, 6months and after 1 year.

4) Fundus examination –

This was done with Welch Allyn direct ophthalmoscope, Keeler's indirect ophthalmoscope and 90 D lens. The condition of optic disc such as size, shape, colour, margins, cup-disc ratio, nasal shifting of vessels, neuroretinal rim and parapapillary area was noted and if possible photographed with fundus camera. Besides this any other abnormality in fundus was also recorded.

Post operatively fundus was accessed after 6 weeks, 6 months and after 1 year.

5) Gonioscopy –

It was done in cooperative patients by Goldman's three mirror gonioscope to access the angle status whether open or closed. Beside these the peripheral anterior synechiae and neovascularisation of the angle, if any were noted.

6) Field Charting –

Field charting was done pre operatively in cooperative patients with good vision. Peripheral field charting was done with the Goldman's perimeter and central field with Bjerrum's screen.

Post operatively field charting was done after 6 weeks, 6 months and after 1 year if possible.

7) Tonometery –

Tonometery was performed with Schiotz's tonometer, with a standard technique in all cases. One particular Schiotz's tonometer was used pre and post operatively.

Post operatively intra ocular pressure was recorded on 3rd, 14th day and then after every 1 month.

## PRE OPERATIVE PREPARATIONS:

The patients were mentally prepared to undergo viscocanalostomy or sub scleral lake trabeculectomy as a surgical treatment of glaucoma. A written consent was taken from the patient or their attendants after explaining them the type of surgery and its complications.

Xylocaine sensitivity was done. The eye lashes were cut a day before operation. Ofloxacin .3% eye drop was installed every one hourly a day before operation. Patient is also given Ciprofloxacin 500mg orally a night before operation and in the morning. To relieve anxiety and to have a sound night sleep before operation Alprazolam .25mg is given. The intra ocular pressure is controlled pre operatively with Acetazolamide 250mg, in suitable doses.

# OPERATIVE PROCEDURES

## ANAESTHESIA

**Topical:** 4% xylocaine eye drops were installed 2 times at 2 minutes interval.

**Regional:** 2% xylocaine with adrenaline in 1:80,000 concentration was given in peribulbar region after mixing it with hylurinidase in concentration of 50 I.U /ml. If necessary retrobulbar anaesthesia was given.

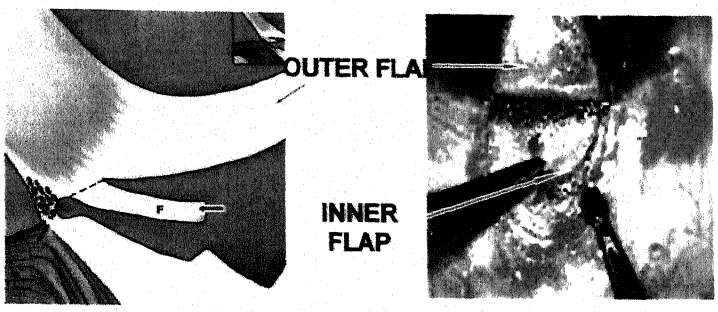
## VISCOCANALOSTOMY

SURGICAL STEPS

- All the operations were done with Leica M 690 microscope.
- Lids were secured with wire speculum and bridal suture to superior rectus was given
- Surgical field is prepared by creating a fornix based Conjunctival flap. To avoid damage to collector channels & Schlemm's canal wet field cautery is used as little as possible.
- Intra scleral flap is prepared, first of all a 5mm X 5mm outer flap of 1/3 partial thickness is dissected followed by an inner concentrically 4mm X 4mm scleral flap, sculpted beneath the previous one, keeping the surface of the lower flap close to the choroids as to have a dark reflex from underlying choroid with the help of 3.2 mm bevelled up crescent blade.
- If the depth of the lower flap is correct, when the lower flap is advanced towards the limbus, Schlemm's canal is deroofed and the two openings of the canal remain patent at the lateral edges of the cut.
- Now an intact window in Descemet's membrane is created by gently pulling the inner scleral flap upwards and delicately depressing the floor of the canal at the schwalbe's line using a tip of a cotton swab or cellulose sponge. The membrane is cleaved from the cornea and the cleavage is advanced into the clear cornea for approximately 1mm.

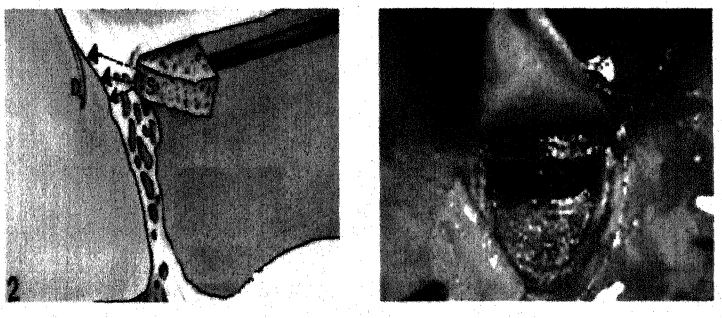
When the window is complete the inner scleral flap is excised with help of Vannas's scissor.

- After this magnification is increased to 25X and a 30G finely polished cannula is introduced in to the ostia or the surgical opening of Schlemm's canal in right and left direction, to inject Viscoelastic for 4 to 6mm on either side so as to increase the diameter and patency of Schlemm's canal so as to avoid collapse and scarring in early post operative period.
- The final step is to seal the lake. This is achieved by the tight suturing of the outer scleral flap by 10-0 monofilament. After this Viscoelastic is injected beneath the scleral flap to temporarily fill the scleral lake, thus preventing it from collapsing and scarring in early post operative period by acting as a barrier to fibrinogen migration.
- Two lateral sutures are given to hold the conjunctiva in place.

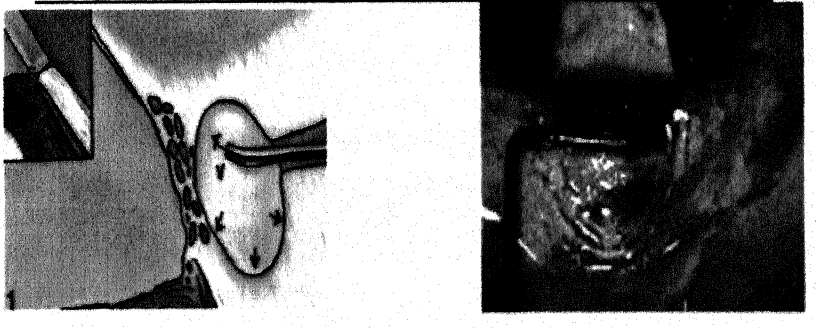



**AN INNER 4mm X 4mm SCLERAL FLAP IS SCULPTURED BENEATH THE OUTER FLAP OF APPROXIMATELY 90% THICKNESS**

**LOWER FLAP IS ADVANCED TOWARDS THE LIMBUS AND THE SCHLEMM'S CANAL IS DEROOFED**



**INTACT WINDOW IN DESCEMET'S MEMBRANE IS CREATED**



**30 G CANNULA IS INTRODUCED INTO THE SURGICAL OPENINGS OF SCHLEMM'S CANAL AND VISCOELASTIC IS INJECTED ON BOTH SIDES FOR 4 TO 5mm**

## SUB SCLERAL LAKE TRABECULECTOMY

SURGICAL STEPS

- All the operations were done with Leica M 690 microscope.
- Lids were secured with wire speculum and bridal suture to superior rectus was given
- Surgical field is prepared by creating a fornix based Conjunctival flap. To avoid damage to collector channels & Schlemm's canal wet field cautery is used as little as possible.
- Intra scleral flap is prepared, first of all a 5mm X 5mm outer flap of 1/3 partial thickness is dissected followed by an inner concentrically 4mm X 4mm scleral flap, sculpted beneath the previous one, keeping the surface of the lower flap close to the choroids as to have a dark reflex from underlying choroid with the help of 3.2 mm bevelled up crescent blade.
- If the depth of the lower flap is correct, when the lower flap is advanced towards the limbus, Schlemm's canal is deroofed and the two openings of the canal remain patent at the lateral edges of the cut.
- The inner scleral flap is excised with help of Vannas's scissor.
- After this magnification is increased to 25X and a 30G finely polished cannula is introduced in to the ostia or the surgical opening of Schlemm's canal in right and left direction, to inject Viscoelastic for 4 to 6mm on either side so as to increase the diameter and patency of Schlemm's canal so as to avoid collapse and scarring in early post operative period.

- Now 1.5 mm anteroposterior by 4 mm wide trabeculectomy block is removed just anterior to scleral spur is removed and iridectomy is done through it.
- The final step is to seal the lake. This is achieved by the tight suturing of the outer scleral flap by 10-0 monofilament.
- Two lateral sutures are given to hold the conjunctiva in place.

POSTOPERATIVE CARE

A combination of ofloxacin .3% and dexamethasone .1% is used six times daily for 1 week. After this it is gradually tapered over a period of 1 ½ months.

FOLLOW UP

The patients were discharged on 3rd post operative day. The patients were advised follow up examination at one week interval for 2 weeks and then after every one month.

Intraocular pressure examination was done by Schiotz's tonometer at the time of discharge that is on 3rd post operative day and then after on every follow up. The visual acuity, any post operative complication and if possible field changes on Goldman perimeter

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# OBSERVATIONS

# OBSERVATIONS

The present study of the role of viscocanalostomy and sub scleral lake trabeculectomy in open angel glaucoma was carried out in the department of Ophthalmology, M.L.B. medical college, Jhansi during the period from November 2001 to March 2003. During this period 20 patients of open angle glaucoma were operated by viscocanalostomy procedure and 40 patients of open angle glaucoma were operated by sub scleral lake trabeculectomy.

All the patients were followed up. The follow up of the patient varied in between 2 months to 1 year. The data collected out of these cases is being presented here in the following tables.

**Table – 1**

**SEX INCIDENCE**

| SEX | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| Males | 5 | 25% | 11 | 27.5% |
| Females | 15 | 75% | 29 | 72.5% |
| Total | 20 | 100% | 40 | 100% |

One eye of 20 patients of open angle glaucoma was operated by viscocanalostomy. In these 20 patients, 5 were male i.e. 25% and 15 were female i.e. 75%, ratio being male : female :: 1 : 3. One eye of 40 patients of

open angle glaucoma was operated by sub scleral lake trabeculectomy. In these 40 patients, 11 were male i.e. 27.5% and 29 were female i.e. 72.5%, ratio being male : female:: 1 : 3.

Table – 2

AGE INCIDENCE

| Age Group | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | Number | % | Number | % |
| 41 – 50 | 4 | 20% | 8 | 20% |
| 51 – 60 | 12 | 60% | 25 | 62.5% |
| 61 – 70 | 4 | 20% | 6 | 15% |
| 71 – 80 | 0 | 0% | 1 | 2.5% |

In viscocanalostomy group the age of the patients varied between 41 – 70 years. 4 patients of age group 41 – 50 years were operated. 12 patients of age group 51 – 60 years were operated. In 61 – 70 years age group 4 patients were operated.The maximum numbers of patients were in $5^{th}$ decade of life i.e. 60% and the mean age of complete group was 55 years.

In sub scleral lake trabeculectomy group the age of the patients varied between 41 – 80 years. 8 patients of age group 41 – 50 years were operated. 25 patients of age group 51 – 60 years were operated. In 61 – 70 years age group 6 patients were operated. While one patient was above 70 years. The

maximum numbers of patients were in 5th decade of life i.e. 62.5%. Mean age of the group is 51.6 years.

Table – 3

SOCIO ECONOMIC STATUS

| Status | VISCOCANALOSTOMY | | | SUB SCLERAL LAKE TRABECULECTOMY | | |
|---|---|---|---|---|---|---|
| | Number | Rural | Urban | Number | Rural | Urban |
| Middle class | 2 (10%) | 0 | 2 | 4 (10%) | 0 | 4 |
| Lower middle class | 6 (30%) | 5 | 1 | 12 (30%) | 10 | 2 |
| Lower class | 12 (60%) | 8 | 4 | 24 (60%) | 16 | 8 |
| Total | 20 | 13 (65%) | 7 (35%) | 40 | 26 (65%) | 14 (35%) |

We divided the patients according to the socio economic status. There were no patients from upper and upper middle class. In viscocanalostomy group only 2 patients were from middle class i.e. 10%, 6 were from lower middle class i.e. 30% and 12 were from lower class i.e. 60%.The maximum numbers of patients were from lower class i.e. 12 patients (60%). We further divided the patients from urban and rural area. The total number of patients from rural area were 13 i.e. 65% and from urban area were 7 i.e. (35%) in this group.

In sub scleral lake trabeculectomy group only 4 patients were from middle class i.e. 10%, 12 were from lower middle class i.e. 30% and 24 were from lower class i.e. 60%.The maximum numbers of patients were from lower class i.e. 24 patients (60%).The patients were further divided according to urban and rural area. The total number of patients from rural area were 26 i.e. 65% and from urban area were 14 i.e. (35%) in this group.

**Table – 4**

**PRE OPERATIVE BEST CORRECTED VISUAL ACUITY**

| Vision | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | Number of eyes | % | Number of eyes | % |
| 6/36 and above | 3 | 15% | 10 | 25% |
| 6/60 – 1/60 | 11 | 55% | 20 | 50% |
| Finger counting | 3 | 15% | 6 | 15% |
| Hand movement | 2 | 10% | 3 | 7.5% |
| PL, PR present | 1 | 5% | 1 | 2.5% |
| Doubtful PL | 0 | 0% | 0 | 0% |

Table – 4 shows best corrected visual acuity pre operatively. In viscocanalostomy group 1 (5%) eye had only PL, PR positive, hand movement was present in 2 (10%) eyes, finger counting was present in 3 (15%) eyes. 11 (55%) eyes had visual acuity 6/60 – 1/60 while 3 (15%) eyes had visual acuity 6/36 and above. The maximum best corrected per operative visual acuity was 6/60 – 1/60 i.e. 11 patients (55%).

In sub scleral lake trabeculectomy group 1 (2.5%) eye had only PL, PR positive, hand movement was present in 3 (7.5%) eyes, finger counting was present in 6 (15%) eyes. 20 (50%) eyes had visual acuity 6/60 – 1/60 while 10 (25%) eyes had visual acuity 6/36 and above. The maximum best corrected per operative visual acuity was 6/60 – 1/60 i.e. 20 patients (50%) in this group.

**Table – 5**

**PRE OPERATIVE INTRAOCULAR PRESSURE**

| IOP (mm Hg) | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | Number of eyes | % | Number of eyes | % |
| 21 – 25 | 4 | 20% | 6 | 15% |
| 26 – 30 | 4 | 20% | 14 | 35% |
| 31 – 35 | 10 | 50% | 15 | 37.5% |
| 36 or above | 2 | 10% | 5 | 12.5% |

In viscocanalostomy group 2 (10%) eyes were having intraocular pressure 36 mm Hg or above, 10 (50%) eyes were having intraocular pressure between 31 – 35 mm Hg, 4 (20%) eyes were having intraocular pressure between 26 – 30 mm Hg and 4 (20%) eyes were having intraocular pressure between 21 – 25 m Hg. The maximum number of eyes had intraocular pressure between 31 – 35 mm Hg i.e. 10 (50%). Mean intraocular pressure of the total group was 30.4 mm Hg.

In sub scleral lake trabeculectomy group 5 (12.5%) eyes were having intraocular pressure 36 mm Hg or above, 15 (37.5%) eyes were having intraocular pressure between 31 – 35 mm Hg, 14 (35%) eyes were having intraocular pressure between 26 – 30 mm Hg and 6 (15%) eyes were having intraocular pressure between 21 – 25 m Hg. The maximum number of eyes had intraocular pressure between 31 – 35 mm Hg i.e. 15 (37.5%). Mean intraocular pressure of total group was 30.5 mm Hg.

**Table - 6**

**PRE OPERATIVE ANTI GLAUCOMA THERAPY**

| Number of drugs | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | Number of eyes | % | Number of eyes | % |
| No drug | 5 | 25% | 10 | 25% |
| One drug | 10 | 50% | 18 | 45% |
| Two drugs | 3 | 15% | 8 | 20% |
| Three drugs | 2 | 10% | 4 | 10% |

In viscocanalostomy group pre operatively 5 (25%) patients were taking no glaucoma therapy. 15 patients were taking anti glaucoma treatment, out of which 10 (50%) were taking one drug, 3 (15%) were taking two drugs and 2 (10%) were taking three anti glaucoma drugs. Maximum 10 (50%) patients were taking anti glaucoma therapy in form of one drug.

In sub scleral lake trabeculectomy group pre operatively 10 (25%) patients were taking no glaucoma therapy. 30 patients were taking anti glaucoma treatment, out of which 18 (45%) were taking one drug, 8 (20%) were taking two drugs and 4 (10%) were taking three anti glaucoma drugs. Maximum 18 (45%) patients were taking anti glaucoma therapy in form of one drug.

**Table – 7**

**TYPE OF CATARACT PRE OPERATIVELY**

| Type of cataract | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | Number of patients | % | Number of patients | % |
| Insignificant | 2 | 10% | 4 | 10% |
| Incipient | 6 | 30% | 14 | 35% |
| Intumescent | 10 | 50% | 18 | 45% |
| Mature | 2 | 10% | 4 | 10% |

Out of 20 patients who underwent viscocanalostomy, pre operatively 2 did not have any significant cataract. 6 patients had incipient cataract, 10 had intumescent cataract and 2 had mature cataract. Maximum 10 patients had intumescent cataract i.e. 50% in viscocanalostomy group.

Out of 40 patients who underwent Sub Scleral Lake Trabeculectomy, pre operatively 4 did not have any significant cataract. 14 patients had incipient cataract, 18 had intumescent cataract and 4 had mature cataract. Maximum 18 patients had intumescent cataract i.e. 45% in sub scleral lake trabeculectomy group.

**Table – 8**

**INTRA OPERATIVE COMPLICATIONS**

| Complications | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | Numbers | % | Numbers | % |
| Hyphema | 6 | 30% | 10 | 25% |
| Iris injury | 1 | 5% | 4 | 10% |
| Schlemm's canal not localised | 2 | 10% | 4 | 10% |
| Button holing of superficial scleral flap | 3 | 15% | 3 | 7.5% |
| Anterior Chamber entry | 2 | 10% | | |

There were no complications recorded pre operatively in any group.

In viscocanalostomy group intra operatively Hyphema occurred in 6 (30%) cases. Anterior chamber entry occurred in 2 (10%) cases. One (5%) case had iris injury. Three (15%) cases had button holing of superficial scleral flap. Schlemm's canal was not located in 2 (10%) of cases. The cases which had accidental anterior chamber entry i.e. 2 and those in which Schlemm's canal was not located i.e. 2, were converted into normal Trabeculectomy i.e. 4 cases.

In sub scleral lake trabeculectomy group intra operatively Hyphema occurred in 10 (25%) cases. 4 (10%) case had iris injury. Three (7.5%) cases had button holing of superficial scleral flap. Schlemm's canal was not located in 4 (10%) of cases.

**Table – 9**

**POST OPERATIVE COMPLICATION**

| Complications | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | Numbers | % | Numbers | % |
| Shallow A.C. | 0 | 0% | 0 | 0% |
| Hyphema | 1 | 5% | 2 | 5% |
| Iritis | 4 | 20% | 10 | 25% |
| Bleb Formation | 3 | 15% | 5 | 12.5% |
| Keratitis | | | 6 | 15% |

In viscocanalostomy group hyphema was seen in 1 case 2nd post operative day and it was absorbed in 10 days. Iritis was noted in 4 cases (20%) and it resolved in 7 days of frequent installation of combination of Ofloxacin .3% and Dexamethasone .1%, and Tropicamide 1% eyedrops once a day. Bleb formation occurred in 3 cases (15%), this was probably due to loose suturing of Scleral flap. Shallow A.C. was not seen in any of the cases.

In sub scleral lake trabeculectomy group hyphema was seen in 2 case on 2nd post operative day and it was absorbed in 10 days. Iritis was noted in 10 cases (25%) and it resolved in 7 days of frequent installation of combination of Ofloxacin .3% and Dexamethasone .1%, and Tropicamide 1% eyedrops once a day. Bleb formation occurred in 5 cases (12.5%), this was probably due to loose suturing of Scleral flap. Keratitis was present in 6 cases i.e. 15%. It cleared within 2 weeks. Shallow A.C. was not seen in any of the cases.

Table – 10

## POST OPERATIVE BEST CORRECTED VISUAL ACUITY

| Vision | VISCOCANALOSTOMY | | | SUB SCLERAL LAKE TRABECULECTOMY | | |
|---|---|---|---|---|---|---|
| | 1 week | 1 month | 6 months | 1 week | 1 month | 6 months |
| 6/36 and above | 3 (15%) | 3 (15%) | 2 (10%) | 8 (20%) | 10 (25%) | 6(15%) |
| 6/60 – 1/60 | 11 (55%) | 10 (50%) | 8 (40%) | 22 (55%) | 14 (35%) | 11 (27.5%) |
| Finger counting | 3 (15%) | 4 (20%) | 6 (30%) | 6 (15%) | 10 (25%) | 16 (40%) |
| Hand movement | 2 (10%) | 2 (10%) | 3 (15%) | 3 (7.5%) | 5 (12.5%) | 6(15%) |
| PL, PR present | 1 (5%) | 1 (5%) | 1 (5%) | 1 (2.5%) | 1 (2.5%) | 1 (2.5%) |
| Doubtful PL | 0 (0%) | 0 (0%) | 0 (0%) | 0 | 0 (0%) | 0 (0%) |

Table – 11

**BEST CORRECTED VISUAL ACUITY PER OPERATIVELY & 6 MONTHS POST OPERATIVELY**

| Vision | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| | **Pre operatively** | **6 Month post op.** | **Pre operatively** | **6 Month post op.** |
| 6/36 and above | 3 (15%) | 2 (10%) | 10 (25%) | 6(15%) |
| 6/60 – 1/60 | 11 (55%) | 8 (40%) | 20 (50%) | 11 (27.5%) |
| Finger counting | 3 (15%) | 6 (30%) | 6 (15%) | 16 (40%) |
| Hand movement | 2 (10%) | 3 (15%) | 3 (7.5%) | 6(15%) |
| PL, PR present | 1 (5%) | 1 (5%) | 1 (2.5%) | 1 (2.5%) |

Comparison of best corrected visual acuity per operatively & 6 months post operatively shows that there was no significant decrease of vision after 6 months of viscocanalostomy. Some diminution of vision was due to normal aging phenomenon or due to accidental A.C. entry. While comparison of best corrected visual acuity per operatively & 6 months post operatively shows that there was significant decrease of vision after 6 months of Sub

Scleral Lake Trabeculectomy. This diminution of vision was due to normal aging phenomenon or due to A.C. entry.

Table – 12

**TYPE OF CATARACT POST OPERATIVELY AFTER 6 MONTHS**

| | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
|---|---|---|---|---|
| **Type of cataract** | **Number of patients** | **%** | **Number of patients** | **%** |
| Insignificant | 2 | 10% | 2 | 5% |
| Incipient | 4 | 20% | 10 | 25% |
| Intumescent | 11 | 55% | 21 | 52.5% |
| Mature | 3 | 15% | 7 | 17.5% |

Table – 13

**TYPE OF CATARACT PRE OPERATIVELY & 6 MONTHS POST OPERATIVELY**

| **Type of cataract** | **Number of patients** | | | |
|---|---|---|---|---|
| | **VISCOCANALOSTOMY** | | **SUB SCLERAL LAKE TRABECULECTOMY** | |
| | **Pre Operatively** | **6 Months post op.** | **Pre Operatively** | **6 Months post op.** |
| Insignificant | 2 (10%) | 2 (10%) | 4 (10%) | 2 (5%) |
| Incipient | 6 (30%) | 4 (20%) | 14 (35%) | 10 (25%) |
| Intumescent | 10 (50%) | 11 (55%) | 18 (45%) | 21 (52.5%) |
| Mature | 2 (10%) | 3 (15%) | 4 (10%) | 7 (17.5%) |

In viscocanalostomy group comparison of cataract pre operatively & 6 months post operatively shows that only one more case advanced to mature cataract and 2 more to intumescent stage. This may be due to normal aging phenomenon or due to accidental A.C. entry.

While in sub scleral lake trabeculectomy group comparison of cataract pre operatively & 6 months post operatively shows that three more case advanced to mature cataract and 6 more to intumescent stage. This was due to normal aging phenomenon or due to A.C. entry.

## Table – 14

## POST OPERATIVE INTRAOCULAR PRESSURE

| Post op. I.O.P. (mm Hg) | Number of eyes | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | VISCOCANALOSTOMY | | | | SUB SCLERAL LAKE TRABECULECTOMY | | | |
| | 3rd Day | 2 weeks | 6 months | 12 months | 3rd Day | 2 weeks | 6 months | 12 months |
| 0 – 6 | 4 | - | - | - | 10 | - | - | - |
| 7 – 12 | 16 | 10 | 8 | 4 | 30 | 20 | 14 | 10 |
| 13 – 21 | - | 10 | 10 | 11 | - | 20 | 24 | 26 |
| 22 – 30 | - | - | 2 | 5 | - | - | 2 | 4 |
| > 30 | - | - | - | - | - | - | - | - |

In viscocanalostomy group post operatively intraocular pressure after 3 days was between 0 – 6 mm Hg in 4 eyes and rest had intraocular pressure between 7 – 12 mm Hg. After 12 months 4 eyes had intraocular pressure between 7 – 12 mm Hg, 11 eyes had intraocular pressure between 13 – 21 mm Hg and 5 eyes had intraocular pressure between 22 – 30 mm Hg. Those eyes which had intraocular pressure more than 21 mm Hg were brought under control by administering .5% timolol maleate eye drops twice daily. Mean intraocular pressure of the total group 12 months post operatively was 16.9 mm Hg.

In sub scleral lake trabeculectomy group post operatively intraocular pressure after 3 days was between 0 – 6 mm Hg of 10 eyes and rest had intraocular pressure between 7 – 12 mm Hg. After 12 months 10 eyes had intraocular pressure between 7 – 12 mm Hg, 26 eyes had intraocular pressure between 13 – 21 mm Hg and 4 eyes had intraocular pressure between 21 – 30 mm Hg. Those eyes which had intraocular pressure more than 22 mm Hg were brought under control by administering .5% timolol maleate eye drops twice daily. Mean intraocular pressure post operatively after 12 months is 14 mm Hg.

Table – 15

PER OPERATIVE AND POST OPERATIVE INTRAOCULAR PRESSURE

| Intraocular pressure (mm Hg) | Number of eyes | | | |
|---|---|---|---|---|
| | VISCOCANALOSTOMY | | SUB SCLERAL LAKE TRABECULECTOMY | |
| | Pre operatively | 12 Months post op. | Pre operatively | 12 Months post op. |
| 0 – 6 | - | - | - | - |
| 7 – 12 | - | 4 | - | 10 |
| 13 – 21 | - | 11 | - | 26 |
| 22 – 25 | 4 | 5 | 6 | 4 |
| 26 - 30 | 4 | - | 14 | - |
| 31 – 35 | 10 | - | 15 | - |
| 36 or above | 2 | - | 5 | - |

In viscocanalostomy group post operatively after 12 months intraocular pressure was less than 21 mm Hg in 15 eyes without any medication as compared to pre operatively where all eyes had intraocular pressure >21 mm Hg. 5 eyes which had intraocular pressure more than 21 mm Hg post operatively were brought under control by administering .5% timolol maleate eye drops twice daily. The mean intraocular pressure pre operatively was 30.4 mm Hg and post operatively 12 months was 16.9 mm of Hg.

In sub scleral lake trabeculectomy group post operatively after 12 months intraocular pressure was less than 21 mm Hg in 36 eyes without any medication as compared to pre operatively where all eyes had intraocular pressure >21 mm Hg. 4 eyes which had intraocular pressure more than 21 mm Hg post operatively were brought under control by administering .5% timolol maleate eye drops twice daily. Mean intraocular pressure pre operatively was 30.5 mm Hg and post operatively after 12 months is 14 mm Hg.

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# DISCUSSION

# DISCUSSION

Glaucoma accounts for 2% of blindness in India, out of which half are due to open angle glaucoma. Till date trabeculectomy is considered as a gold standard in glaucoma surgery but it has complications due to anterior chamber entry and, due to conjunctival filtering bleb such as hypotony & flat anterior chamber, uveitis & hyphema, leaking of filtering bleb, dellen, cataract and endophthalmitis. To eliminate these complications we used a non penetrating filtering surgery known as viscocanalostomy for treatment of open angle glaucoma in a series of 20 patients. Viscocanalostomy is a new procedure, first proposed by Robert Stegman in 1991. The technique is non penetrating & independent from external filtration. The lack of direct entry in to anterior chamber leads to less risk of infection, cataract, hypotony and flat anterior chamber. The absence of external filtration avoids bleb formation and related discomforts. It also reduces the risk of late infections, and most importantly, the success of the procedure is independent of Conjunctival or Episcleral scarring.

The rationale for the technique is based on the evidence, that the site of greatest aqueous outflow resistance in open angle glaucoma is the trabecular meshwork. Viscocanalostomy is aimed at creating a bypass, through which the aqueous can reach Schlemm's canal directly and then leave the eye through the normal physiological pathway, without passing through the trabecular meshwork. This is done by making a chamber in sclera known as

sub scleral lake, and an intact window is created in Descemet's membrane, just anterior to trabecular meshwork, through which aqueous diffuses from the anterior chamber in to the sub scleral lake and then leaves, by directly entering the Schlemm's canal.

Also we at the Department of Ophthalmology, Maharani Laxmi Bai Medical College, Jhansi, modified viscocanalostomy by combining it with trabeculectomy in which sub scleral lake was made, without the formation of the conjunctival filtering bleb as a treatment for patients of primary open angle glaucoma and termed it SUB SCLERAL LAKE TRABECULECTOMY. We performed this procedure on a series of 40 patients. Here we tried to minimise the complications due to anterior chamber entry as shallow or flat anterior chamber, hypotony, choroidal detachment, and hypotony maculopathy. This procedure was independent of filtering conjunctival bleb hence complication due to the bleb such as blebitis, leaking of filtering bleb, dellen, and non functional bleb were eliminated.

In both the above procedures aqueous from the sub scleral lake leaves the eye via ostia to the Schlemm's canal, without a need for internal filtration. The aqueous also leaves the lake through the thin scleral layer in to the suprachoroidal space. Here no filtration of aqueous occurs through the conjunctiva and no conjunctival bleb is formed.

This study consisted of a series of 60 patients of open angle glaucoma, out of which 20 patients underwent viscocanalostomy and 40 underwent sub scleral lake. The patients were randomly selected for either of the procedure. These cases were thoroughly studied in pre operative, operative and post operative period to access the result of viscocanalostomy and sub scleral lake trabeculectomy. The findings of the study are being analysed and discussed below.

**SEX:** As shown in table – 1 most of our patients were female i.e. 75%. This is in contrast to other studies which has higher prevalence of males Khan HA, Milton RC (1980); Leske MC (1994); Ekstrom C (1996). This may be probably due to regional variation.

**AGE:** As shown in table – 2 the age of the patients with open angle glaucoma varied from 41 to 80 years. The maximum numbers of the patients were of the age group of 51 – 60. This shows open angle glaucoma is basically a problem of geriatric people. This is similar to prevalence of open angle glaucoma found in other studies Hollows FC, Graham PA (1966); Leibowitz HM (1980); Klein BE (1992).

**SOCIO ECONOMIC STATUS:** Table – 3 shows that most of our patients were from lower socio economic status and rural background. This may be due to the fact that most people attending our O.P.D. are from rural background and of lower socio economic status.

**VISUAL ACUITY AND CATARACT FORMATION:** Table – 4 shows that most of the patients of viscocanalostomy and sub scleral lake trabeculectomy group had best corrected visual acuity between 6/60 – 1/60. Table – 10 shows that Post operative visual acuity after 6 months after viscocanalostomy was between 6/60 – 1/60 in most of the patients; but after sub scleral lake trabeculectomy was finger counting in most of the patients.

Table – 11 shows a comparison of pre operative and post operative visual acuity after 6 months of viscocanalostomy and sub scleral lake trabeculectomy. It shows that there was no significant decrease of vision after 6 months of viscocanalostomy, some diminution of vision was due to normal aging phenomenon or due to accidental A.C. entry. There was significant decrease of vision after 6 months of Sub Scleral Lake Trabeculectomy. This diminution of vision was due to A.C. entry or due to normal aging phenomenon.

Table – 7 shows that most of the patient undergoing viscocanalostomy and sub scleral lake trabeculectomy had incipient and intumescent cataract post operatively. Table – 12 and 13 shows post operatively after 6 months there was almost no change in type cataract in viscocanalostomy group; but in patients who under went sub scleral lake trabeculectomy, there was a significant change in type of cataract and most of the cases had advanced to a higher stage.

Anterior chamber entry in trabeculectomy leads to cataract formation and hence decreases in visual acuity in 20 to 40% of the patients Lamping K.,

Bellows AR, Hutchinson BT (1986). The results of viscocanalostomy shows that this non penetrating filtering surgery do not cause cataract formation and hence insignificant decrease in visual acuity if intra ocular tension is also controlled in this group. But the results of sub scleral lake trabeculectomy shows that there was a significant change in type of cataract and most of the cases had advanced to a higher stage; these results are similar to trabeculectomy where there is rapid advancement to higher stage cataract.

**INTRA OPERATIVE COMPLICATIONS:** Table – 8 shows intra operative complications.

In Viscocanalostomy intra operatively Hyphema occurred in 6 (30%) cases. Carassa RG (2002) reported it in 11% of cases. Anterior chamber entry occurred in 2 (10%) cases. One (5%) case had iris injury. Three (15%) cases had button holing of superficial scleral flap. Schlemm's canal was not located in 2 (10%) of cases. The cases which had accidental anterior chamber entry i.e. 2 and those in which Schlemm's canal was not located i.e. 2, were converted into normal Trabeculectomy i.e. 4 cases. The higher rate of complications in viscocanalostomy in this study as compared to other studies Carassa RG (2002), Stegmann R (1999) can be attributed to learning curve.

In sub scleral lake trabeculectomy intra operatively Hyphema occurred in 10 (25%) cases. 4 (10%) case had iris injury. Three (7.5%) cases had button

holing of superficial scleral flap. Schlemm's canal was not located in 4 (10%) of cases. These complications can also be attributed to learning curve.

**POST OPERATIVE COMPLICATIONS:** Table – 9 shows intra operative complications.

In viscocanalostomy hyphema was seen in 1 case 2nd post operative day and it was absorbed in 10 days. Iritis was noted in 4 cases (20%) and it resolved in 7 days of frequent installation of combination of Ofloxacin .3% and Dexamethasone .1%, and Tropicamide 1% eye drops once a day. Bleb formation occurred in 3 cases (15%), this was probably due to loose suturing of Scleral flap. Shallow A.C. was not seen in any of the cases.

In sub scleral lake trabeculectomy hyphema was seen in 2 case 2nd post operative day and it was absorbed in 10 days. Iritis was noted in 10 cases (25%) and it resolved in 7 days of frequent installation of combination of Ofloxacin .3% and Dexamethasone .1%, and Tropicamide 1% eye drops once a day. Bleb formation occurred in 5 cases (12.5%), this was probably due to loose suturing of Scleral flap. Keratitis was present in 6 cases i.e. 15%. It cleared within 2 weeks. Shallow A.C. was not seen in any of the cases.

The above results show that that there were very less post operative complications in viscocanalostomy. There was no case of flat or shallow anterior chamber. The complications in sub scleral lake trabeculectomy were

similar to trabeculectomy but there was no case of shallow or flat anterior chamber which is a most dreaded complication in trabeculectomy. As eye did not land in hypotony at any stage, so there were no complications of choroidal detachment and hypotony maculopathy. These procedures were independent of filtering conjunctival bleb hence complication due to the bleb such as blebitis, leaking of filtering bleb, dellen, and non functional bleb were not seen.

**INTRA OCULAR PRESSURE:** Table – 5 shows pre operative intra ocular pressure. Mean pre operative intraocular pressure in viscocanalostomy group was 30.4 mm Hg and in sub scleral lake trabeculectomy group was 30.5 mm Hg.

Table – 6 shows that 75% of patients were taking per operative glaucoma therapy in both the groups.

Table – 14 shows post operative intraocular pressure. The mean intra ocular pressure after 12 months in viscocanalostomy group was 16.9 mm Hg. Only 5 patients had intra ocular pressure between 22 – 30 mm Hg. Those eyes which had intraocular pressure more than 21 mm Hg were brought under control by administering .5% timolol maleate eye drops twice daily. This shows that 75% of eyes operated for viscocanalostomy had intra ocular pressure between 7 – 21 mm of Hg without any medication. Carassa RG (2002) showed 86.2% success; Stegmann R, Pienaar A, Miller D (1999) showed 82.7% success without medication. Our lower success rate as

compared to others may be due to a learning curve associated with any new technique.

The mean intraocular pressure after 12 months in sub scleral lake trabeculectomy group was 14 mm Hg. Only 4 patients had intra ocular pressure between 22 – 30 mm Hg. Those eyes which had intraocular pressure more than 21 mm Hg were brought under control by administering .5% timolol maleate eye drops twice daily. This shows that 90% of eyes operated for sub scleral lake trabeculectomy had intra ocular pressure between 7 – 21 mm of Hg without any medication.

Lower mean intra ocular pressure was obtained in sub scleral lake trabeculectomy group than viscocanalostomy group as well as the success rate was also higher in sub scleral lake trabeculectomy group. This can be due to the fact that we are also removing 1.5 mm anteroposterior by 4 mm wide trabeculectomy block just anterior to scleral spur and also doing iridectomy through it in sub scleral lake trabeculectomy.

In open angle glaucoma pressure levels of 21 mm Hg or lower is achieved in about 80% to 90% of eyes after trabeculectomy Lamping KA (1986); Spaeth GL (1980); Shields MB (1980). The results of viscocanalostomy and sub scleral lake trabeculectomy are comparable to standard trabeculectomy.

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# CONCLUSIONS

# CONCLUSIONS

The present study of role of viscocanalostomy and sub scleral lake trabeculectomy in open angle glaucoma was carried out in Department of Ophthalmology, M.L.B. Medical college, Jhansi between November 2001 to March 2003. During this period 20 patients of open angle glaucoma were operated by viscocanalostomy procedure and 40 patients of open angle glaucoma were operated by sub scleral lake trabeculectomy. All the patients were followed up. The review of observations and results lead to following concluding points:

1. Open angle glaucoma is basically a problem of geriatric people.
2. Incidence of open angle glaucoma appeared mainly in females in Bundelkhand region.
3. Post operative visual acuity shows that there was minimal diminution of vision in viscocanalostomy group after surgery; but rate of diminution of vision in Sub scleral lake trabeculectomy is almost equivalent to conventional trabeculectomy.
4. Rate of post operative cataract progression after viscocanalostomy procedure was minimal as compared to trabeculectomy; but it was almost same as that of trabeculectomy in sub scleral lake trabeculectomy.

5. The intra ocular pressure control was very good in both viscocanalostomy and sub scleral lake trabeculectomy, almost similar to trabeculectomy.
6. There were very less post operative complications in viscocanalostomy. There was no case of flat or shallow anterior chamber. The complications in sub scleral lake trabeculectomy were similar to trabeculectomy but there was no case of shallow or flat anterior chamber which is a most dreaded complication in trabeculectomy. These procedures were independent of filtering conjunctival bleb hence complication due to the bleb such as blebitis, leaking of filtering bleb, dellen, and non functional bleb were not seen.
7. The mean post operative intra ocular pressure obtained after viscocanalostomy was 16.9 mm Hg and sub scleral lake trabeculectomy was 14 mm Hg 12 months post operatively. Intra ocular pressure control with sub scleral lake trabeculectomy is better than that of viscocanalostomy.
8. Viscocanalostomy and sub scleral lake trabeculectomy seems promising procedures for lowering intra ocular pressure in glaucomatous eyes. If the positive preliminary results continue, the procedure could be indicated in all eyes at high risk of failure with trabeculectomy due to bleb related problems and hypotony.

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# BIBLIOGRAPHY

# BIBLIOGRAPHY


1. Alm A, and others: Intraocular reducing effect of PHXA41 in patients with increased eye pressure: a one month study. Ophthalmology 100:1312, 1993.
2. Altan T, and others: Hypotonic maculopathy after trabeculectomy with post operative use of 5-fluorouracil, Ophthalmologica 208:318, 1994.
3. Amar Agarwal: Text book of Ophthalmology 2002, 1527 – 1562.
4. Ancker E, Moltena AC: Surgical treatment of chronic Aphakic glaucoma with the Molteno plastic implant, Klin Monatsbl Augenheilkd 177:365, 1980.
5. Bader: Trans. Int. med. Cong.,London, 7th Sess., 3,98 (1881). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
6. Banister: A Treatise of one hundred and thirteen diseases of the eyes and eyelids, London (1622). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
7. Barkan: Amer. J. Ophthal., 19, 951 (1936); 20, 1237 (1937); 21, 1099 (1938); 42, 63(1956). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
8. Barkan: Amer. J. Ophthal., 19, 951 (1936); 21, 1099 (1938); 36, 445 (1953). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
9. Becker: Acta XVII int. Cong. Ophthal., Montreal-N.Y., 2, 1109 (1954). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

10. Benjamin F. Byod: Highlights of Ophthalmology No. 4, 2000 series.
11. Bietti: J. Amer. Med. Ass.,142, 889 (1950). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
12. Blondeau P, Phelps CD: Trabeculectomy Versus Thermosclerostomy: a randomized prospective clinical trial. Arch Ophthalmol 99:810, 1981.
13. Bock: Amer. J. Ophthal., 33, 929 (1950). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
14. Brisseau: Traite' de la cataracte et du gloucome, Paris (1709). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
15. Brown RD, Crains JE: Experience with the Molteno long tube implant, Trans Ophthalmol Soc UK 103:297, 1983.
16. Brown RH, and others: Treatment of bleb infection after glaucoma surgery, Arch Ophthalmol 112:57, 1994.
17. Brubaker RF, Schoeff EO, Nau CB, et al. Effects of AGN 192024, A new Ocular hypotensive agent, on aqueous humor dynamics. Am J Ophthalmol. 2001; 131: 19 – 24.
18. Bucci MG and others: La somministrazione locale del Propranolol nella terapia del glaucoma, Boi ocul 47: 51, 1968.
19. Burney EN, Quigley HA, Robin AL: Hypotony and choroidal detachment as late complications of trabeculectomy, Am J Ophthalmol 103:865, 1987.
20. Camras CB, Bito LZ, Eakins KE: Reduction of intraocular pressure by prostaglandins applied topically to the eyes of conscious rabbits. Invest Ophthalmol Vis Sic 16:1125, 1977.

21. Camras CB, Bito LZ: Reduction of intra ocular pressure in normal and glaucomatous primate (Aotus trivirgatus) eyes by topically applied prostaglandin $F_2$, Curr Eye Res 1:205, 1981.
22. Cantonnet: Arch. Ophthal., 24, 1 (1904). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
23. Chen CW, and others: Trabeculectomy with simultaneous topical application of Mitomycin-C in refractory glaucoma, J Ocul Pharmacol 6:175, 1990.
24. Chen PP, and others: Outpatient treatment of bleb infection, Arch Ophthalmol 115:1124, 1997.
25. Ciulla TA, and others: Blebitis, early endophthalmitis, and late endophthalmitis after glaucoma-filtering surgery, Ophthalmology 104:986, 1997.
26. Coccius: v. Graefes Arch. Ophthal., 9 (1), 1 (1863). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
27. Coleman AL, and others: Initial clinical experience with the Ahmed glaucoma valve implant, Am J Ophthalmol 120:23, 1995.
28. Cote G, Drance SM: The effect of Propranolol on human intraocular pressure, Can. J. Ophthalmol. 3:207, 1968.
29. Critchett: roy. Lond. Ophthal. Hosp. Rep., 1, 57 (1857). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
30. Cruise: Trans. Ophthal. Soc. U.K., 41, 248 (1921). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
31. Curran: Arch. Ophthal.,49, 131 (1920). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

32. David L. Easty, John M. Sparrow: Oxford text book of Ophthalmology 1999; 1215.

33. de Vincentiis: Ann. Ottal., 22, 540 (1983).

34. de Wecker: Ann. Oculist. (Paris), 111, 321 (1894). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

35. de Wecker: Bull. Soc. Franc. Ophthal., 18, 1 (1901). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

36. de Wecker: Klin. Mbl. Augenheilk., 9, 305 (1871). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

37. de Wecker: Traite theoretique et pratique des maladies des yeux, Paris (1863 – 67). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

38. de.Roetth: Amer. J. Ophthal., 61, 443 (1966).

39. Dellaporta A: Fundus changes in post operative hypotony, Am J Ophthalmol 40:781, 1955.

40. Demours: Traite' des maladies des yeux, Paris. 1, 470 (1818). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

41. Dhaliwal R, Meredith T: Endophthalmitis. In Charlton J, Weinstein G, editors: Ophthalmic surgery complications, Philadelphia, 1995. Lippincott-Raven.

42. Dianoux: Ann. Oculist. (Paris), 133, 81 (1905). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

43. Donders: v. Graefes Arch. Ophthal., 8 (2), 124 (1862). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

44. Duke- Elders: Glaucoma: a symposium, Oxon., 315 (1955). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
45. Ekstrom C: Prevalence of open angle glaucomain central Sweden. The Tierp Glaucoma survey, Acta Ophthalmol Scand 74:107, 1996.
46. Elliot: Arch. Ophthal., 8, 797 (1932). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
47. Elliot: Ophthalmoscope, 7, 804, 807 (1909); 8, 482, 779 (1910). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
48. Ellis: Amer. J. Ophthal., 50, 733 (1960).
49. Epstein: Brit. J. Ophthal., 43, 641 (1959).
50. Fergus: Brit. Med. J., 2, 983 (1909). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
51. Gass J: Hypotonus maculopathy. In Bellows J, editor: Contemporary Ophthalmology: honouring Sir Stewart Duke Elder, Baltimore, 1972, Williams & Wilkins.
52. Gradle: Amer. J. Ophthal., 7, 603 (1924); 29, 520 (1946). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
53. Guthrie: Lectures on the operative surgery of the eye, London, 214 (1823). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
54. Hamburger: Med. Klin., 19, 1224 (1923). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.
55. Haye, Haut and Mondon: Bull. Soc. Ophthal. Fr., 67, 383(1967).
56. Heine: Ber. dtsch. Ophthal. Ges., 32, 3 (1905). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

57. Herbert: Ophthalmoscope, 5, 292 (1907); 9, 762 (1911; 11, 398 (1913). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

58. Hertel: Klin. Mbl. Augenheilk., 51 (2) 351 (1913). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

59. Hollows FC, Graham PA: Intraocular pressure, glaucoma and glaucoma suspect in a defined population, Br J Ophthalmol 50:570, 1966.

60. Holth: Ann Oculist. (Paris), 137, 345 (1907); 142, 1 (1909). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

61. Hotehana Y, and others: Ocular hypotensive effect of PHXA41 in patients with ocular hypertension or primary open angle glaucoma, Jpn J Ophthalmol 37:270, 1993.

62. Jacobson: De glauconate (Diss.) Konigsberg (1953). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

63. Kangas TA, and others: Delayed-onset endophalmitis associated with conjunctival filtering blebs, Ophthalmology 104:746, 1997.

64. Katz IM and others: Intra ocular pressure decrease in normal volunteers following timolol ophthalmic solution, Invest Ophthalmol Vis Sic 15:489, 1976.

65. Khan HA, Milton RC: Alternative definitions of open angle glaucoma: effect on prevalence and association in the Farmingham eye study, Arch Ophthalmol 98:2172, 1980.

66. Klein BE, and others: Prevalence of glaucoma. The Beaver Dam eye study, Ophthalmology 99:1499, 1992.

67. Krwawicz and Szware: Klin. Oczna, 35, 191 (1965).

68. Lagrange, F. Bull. Soc. franc. Ophtal., 23, 477 (1906). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

69. Lamping KA, Belkin JK: 5-Fluorouracil and Mitomycin-c in pseudophakic patients, Ophthalmology 102:70, 1995.

70. Lamping KA, and others: long term evaluation of initial filtration surgery, Ophthalmology 93:91, 1986.

71. Laqueur: v. Graefes Arch. Ophthal., 23 (3), 149 (1877). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

72. Leibowitz HM, and others: The Framingham Eye Study: monograph, Surv Ophthalmol 24 (suppl):1, 1980.

73. Leske MC, and others: The Barbados eye study: prevalence of open angle glaucoma, Arch Ophthalmol 112:82, 1992.

74. Lewis RA, Phelps CD: Trabeculectomy vs thermosclerostomy: a five year follow-up, Arch Ophthalmol 102:533, 1984.

75. Lundy DC, and others: Intracameral tissue plasminogen tissue activator after glaucoma surgery: indications, effectiveness, and complications, Ophthalmology 103:274, 1996.

76. M. Bruce Shields: Text book of glaucoma 1998; 5 – 25, 153 – 168, 504 – 528.

77. Mackenzie: A practical Treatise on the diseases of the eye, London, 1st ed. (1830); 2nd ed. (1835); 3rd ed. (1854). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

78. Mai G, Yang S: Relationship between corneal dellen and tear film breakup time, Yen Ko Hsueh Pao 7:43, 1991.

79. Mermovd: Non – penetrating filtering glaucoma surgery 2001.

80. Migdal C, Hitchings R: Morbidity following prolonged postoperative hypotony after trabeculectomy, Ophthalmic Surg 19:865, 1988.

81. Molteno ABC: New implant for drainage in glaucoma, Br J Ophthalmol 53:164, 1969.

82. Molteno ABC: The use of draining implants in resistant cases of glaucoma: late results of 110 operations. Trans Ophthalmol Soc NZ 35:94, 1983.

83. Nagasubramamian S, and others: Intra ocular reducing effect of PHXA41 in ocular hypertension: comparison of dose regimens, Ophthalmology 100:1305, 1993.

84. Ohrstrom A: Clinical experience with Propranolol in the treatment of glaucoma. Acta Ophthalmol (Copenh) 51: 639, 1973.

85. Papst W. Brunke R: Gonioterpanation as a secondary fistulazing procedure [author's translation], Klin Monatsbl Augenheilkd 176:915, 1980.

86. Parinaud: Bull. Soc. Franc. Ophtal., 18, 20 (1901). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

87. Phillips Cl, Howitt G, Rowlands DJ: Propranolol as an ocular hypotensive agent, Br. J Ophthalmol. 51:222, 1967.

88. Prata JA Jr, and others: Trabeculectomy in pseudophakic patients: postoperative 5-fluorouracil versus intra operative Mitomycin-C anti proliferative therapy, Ophthalmic Surg 26:73, 1995.

89. Prata JA Jr. and others: In vitro and in vivo flow characteristics of glaucoma drainage implants, Ophthalmology 102:894, 1995.

90. Preziosi: Brit. J. Ophthal., 8, 414 (1914). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

91. Qadeer: Brit. J. Ophthal., 38, 353 (1954). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

92. Quaglino: Ann. Ottal., 1, 200 (1871). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

93. Robertson, Argyll: Roy. Lond.ophthal. Hosp. Rep. 8, 404 (1876). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

94. Rollet: Rev. gen. Ophthal., 26, 289 (1907). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

95. Row: Arch. Ophthal., 12, 325 (1934). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

96. Salzmann: Z. Augenheilk., 31, 1 (1914); 34, 26, 160 (1915). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

97. Scheie, Frayer and Spencer: Arch. Ophthal., 53, 839 (1955). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

98. Scheie: Trans. Canda. Ophthal. Soc., 10, 31, 129 (1958). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

99. Schocket SS, Lakhanpal V, Richards RD: Anterior chamber tube shunt to the encircling band in the treatment of refractory glaucoma, Ophthalmology 89:1188, 1982.

100. Schocket SS: Investigation of the reasons of success and failure in the anterior shunt to the encircling band procedure in the treatment of refractory glaucoma, Trans Am Ophthalmol Soc 84:743, 1986.

101. Seidel: v. Graefes Arch. Ophthal., 102,415 (1920). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

102. Sharma SL, Singh T: Clinical evaluation of trabeculectomy operation in Aphakic glaucoma, Indian J Ophthalmology 29:227, 1981.

103. Shields MB: Trabeculectomy vs full-thickness filtering operation for control of glaucoma, Ophthalmic Surg 11:498, 1980.

104. Sir Stewart Duke-Elder: Systems of Ophthalmology, vol XI, 376 – 561.

105. Smith, Priestley: Glaucoma, its causes, symptoms, pathology and treatment, London (1879). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

106. Spaeth GL, Poryzees E: A comparison between peripheral iridectomy with thermal sclerostomy and trabeculectomy: A controlled study, Br J Ophthalmol 65: 783, 1981.

107. Spaeth GL, Joseph NH, Fernandes E: Trabeculectomy: a re-evaluation after three years and comparison with Scheie's procedure, Trans Am Acad Ophthalmol Otolaryngol 79:349, 1975.

108. Spaeth GL: A prospective, controlled study to compare the Scheie procedure with watson's trabeculectomy. Ophthalmic Surg 11:688, 1980.

109. Spaeth GL: Flat anterior chamber. In Sherwood MB, Spaeth GL, editors: Complications of glaucoma surgery, Thorofare, NJ, 1990, Slack.

110. Starr MS: Further studies on the effect of prostaglandins on intraocular pressure in the rabbit, Exp Eye Res 11:170, 1971.

111. Stegmann R, Pienaar A, Miller D: Viscocanalostomy for open angle glaucoma in black African patients. J Cataract Refract Surg 1999; March, 25 (3), 316 – 322.

112. Stellwag von Carion: Lhb. D. praktischen Augenheilkunde, Wien (1870). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

113. Sugar: The glaucomas, N.Y. (1951). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

114. Suzuki Y, and others: Transscleral Nd:YAG laser cyclophotocoagulation versus cryotherapy, Graefes Arch Clin Exp Ophthalmol 229:33, 1991.

115. Takase M, and others: Ocular effects of topical installation of UF-012 ophthalmic solution in healthy volunteers, Nippon Ganka Zasshi 96:1261. 1992.

116. Thiel, R. Ber. Dtsch. Ophthal. Ges., 44, 118 (1924). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

117. Troutman: Acta XVII int. cong. Ophthal., Montreal-N.Y., 2, 674 (1954). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

118. Varelles P. and others: Comparison of timolol and other adrenergic agents on intra ocular pressure in the rabbit, Invest Ophthalmol Vis Sic 16:987, 1977.

119. Vogt: Arch. Ophthal., 1, 856 (1937). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

120. von Graefe: v. Graefes Arch. Ophthal., 1 (1), 317: (2), 299 (1854): 2 (1), 248 (1855); 3 (2), 456 (1857). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

121. von Graefe: v. Graefes Arch. Ophthal., 3 (2), 456 (1857). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

122. Watkins PH Jr,Brubaker RF: Comparison of partial thickness and ful thickness filtration procedure in open angle glaucoma, Am J Ophthalmol 86:756, 1978.

123. Weber: Korresp. Bl. Med. Wiss., 14, 986 (1876). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

124. Weber: v. Graefes Arch. Ophthal., 2 (1), 133 (1855); 23 (1), 1 (1877).

125. Weekers, L. and R.: Brit. J. Ophthal., 32, 904,(1948). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

126. Weekers, R. and Prijot: Ophthalmologica, 123, 365 (1952). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

127. Weinstein P: Receptor paralyzing agents applied in treatment of glaucoma simplex. Intern Zeitschrift Klin Pharmakol Ther Toxikol 2:374, 1969.

128. Weller: Die Krankheiten d.mensch. Auges, 3rd ed., Berlin, 295, 474 (1826). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

129. Weve. Ned. T. Geneesk., 76, 5335 (1932). Quote. Duke – Elder: System of Ophthalmology, Vol XI, 1969.

130. Wilson MR: Posterior lip sclerostomy vs. trabeculectomy in West Indian blacks, Arch Ophthalmol 107:1604, 1989.

131. Woodward DF, Krauss AH-P, Chen J, at al: The pharmacology of bimatoprost. Surv Ophthalmol. 2001; 45 (suppl 4): S337 – S345.

132. Wu Dunn D: Intracameral urokinase for dissolution of fibrin or blood clots after glaucoma surgery, Am J Ophthalmol 124:693, 1997.

133. Zimmerman TJ, Kaufman HE: Timolol a beta-adrenergic blocking agent for the treatment of glaucoma. Arch Ophthalmol 95:601, 1977.

134. Carassa RG, Bettin P, Flori M, Brancato R: Viscocanalostomy a pilot study, Eur J Ophthalmol 1998 Apr.- Jan.; 8(2): 57-61.

135. Jonescu- Cuyhers C, Jacobi P, Konen W, Krieglstein G: Primary viscocanalostomy versus trabeculectomy in white patients with open angle glaucoma: A randomized clinical trial, Ophthalmology 2001 Feb; 108(2): 254-8.

136. Drusedau MU, Von Wolff K, Von Barseunisch B: Viscocanalostomy for primary open angle glaucoma: the gross Pankow experience, J Cataract and Refractive Surg 2000 Sept., 26(9):1367.

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